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TEXAS AGRICULTURAL EXPERIMENT STATION

A. B. CONNER, DIRECTOR
COLLEGE STATION, BRAZOS COUNTY, TEXAS

BULLETIN NO. 388 OCTOBER, 1928

DIVISION OF AGRONOMY

DENTON WHEAT, A NEW VARIETY FOR NORTH TEXAS

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
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***In cooperation with the School of Agriculture.

SYNOPSIS

Denton wheat is a pure-line selection of Mediterranean wheat, developed by Texas Substation No. 6 at Denton, Texas. It represents the chief product of a program of pure-line selection started in 1920 with 520 individual heads selected from a field of ordinary Mediterranean. The poorer lines were discarded from time to time; the better lines were increased and tested for yield, rust resistance, stiffness of straw, and baking quality. The strain now named Denton wheat, though not the best in any one respect, appeared to combine to a greater degree than any other strain, the desirable qualities that were being sought.

Denton wheat is a typical Mediterranean wheat in practically all characters except stem color. It has proved to be superior in yield, rust resistance, strength of straw, and baking quality to the varieties commonly grown in North Texas, and will probably replace to a large extent the varieties now grown in that region. This Bulletin presents all the data and facts regarding Denton wheat which are now available.

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DENTON WHEAT, A NEW VARIETY FOR NORTH TEXAS

A. H. LEIDIGH,* P. C. MANGELSDORF AND P. B. DUNKLE

Texas Substation No. 6, established in Denton County in 1910, for the purpose of attacking the problems confronting the small-grain region of North Texas, has, almost since its inception, devoted its major efforts toward improvement in the yields of wheat. The experimental work involved in accomplishing this program of improvement has passed through several stages. It began with simple variety testing to determine the adaptation of varieties already existing, followed by mass selection to purify, partially, the best of the local varieties, and has proceeded finally to an extensive program of pure-line breeding. This pure-line selection has resulted in the isolation of a large number of pure strains of wheat, many of which proved to be superior to the mixed wheat ordinarily grown in North Texas and a few of which were given a limited distribution to farmers. The best of these strains, a selection of Mediterranean wheat, has been given the variety name "Denton" and has been increased and disseminated as rapidly as the supply of seed would permit.

The acreage planted to this new variety is increasing as rapidly as seed becomes available and Denton wheat promises to replace a large part of the acreage now devoted to Mediterranean and other varieties.

This Bulletin has been prepared to give all the information which the Station now has available on the origin, development, yield, and other characteristics of Denton wheat.

HISTORY OF MEDITERRANEAN WHEAT

As Denton wheat is a pure-line selection from the Mediterranean variety and is a typical Mediterranean wheat in most important characters, it may be of interest in this connection to record briefly the history of Mediterranean wheat in the United States and particularly in Texas.

Regarding the introduction of Mediterranean wheat into the United States, Clark, Martin and Ball† make the following statement:

"Reference to the Mediterranean variety in American literature begins in 1842, when the variety was widely grown, with the statement that it had been introduced some years before. One writer says it was introduced into Maryland from the Mediterranean Sea region in 1837. In 1863 it was recorded that it was introduced in 1819 from Genoa, Italy, by John Gordon, of Wilmington, Del. It came into prominence in New York between 1845 and 1855, from which time its culture spread rapidly

*Former Agronomist in charge of small grain investigations.

†Classification of American Wheat Varieties, U. S. Dept. Agric. Bull. 1074, p. 166.

westward. Its early popularity apparently was gained because it was more resistant to Hessian fly damage than other varieties."

The date of introduction of Mediterranean wheat into Texas is not accurately known. The variety has been grown to some extent since about 1881 or earlier. In 1921 the Texas Station obtained seed of Mediterranean wheat from the Underwood Brothers of Denton, who stated that this particular strain had been brought into Denton County by J. W. Underwood, at least 40 years previously, or about 1881.

Mediterranean wheat appears to have been the variety most commonly grown in North Texas in the nineties. Bulletin No. 34 of the Texas Station published in 1895, reports variety tests of wheat made at McKinney in 1893, in which 215 varieties, most of which were introduced from Oklahoma and Kansas, were tested in order to find if possible a variety promising "larger yields per acre and of equally as good quality of grain as is produced from the common Mediterranean of North Texas."

In 1919 the Mediterranean variety exceeded all others in acreage in Texas. A survey made in that year by the U. S. Department of Agriculture* shows that 1,331,900 acres were planted to Mediterranean and that this variety occupied 55 per cent of the wheat acreage of Texas.

Because of the prevalence of volunteer wheat in Texas, thresher mixtures, natural hybridization, and perhaps other factors, the Mediterranean wheat commonly grown in Texas today, represents a wide assortment of many distinct types.

DEVELOPMENT OF DENTON WHEAT

Realizing the importance of Mediterranean wheat in North Texas and recognizing the fact that the variety as commonly grown is a complex mixture of many different types, Texas Substation No. 6 at Denton undertook the purification and improvement of this variety through pure-line selection.

In 1920 Mr. A. H. Leidigh, former agronomist in charge of small-grain investigations and Mr. C. H. McDowell, former superintendent of Substation No. 6, selected 520 heads of Mediterranean T. S. No. 3015, a strain which had been obtained from Mr. A. M. Ferguson, of Sherman, in 1918, and which had been continuously grown in Grayson County for at least 20 years previously. This particular lot had shown up well in several variety tests, but was typical of Texas Mediterranean in containing a mixture of hard and soft, bearded and beardless and other contrasting types.

The 520 heads were threshed separately and the seed sown in the fall of 1920 in "head rows" five feet long and one foot apart. The poorer strains were eliminated from time to time and the better ones increased until 1926, when strain No. 3015-66 was decided upon as the best strain from the standpoint of yield, rust resistance, and strength of straw.

*Reported in U. S. Dept. Agric. Bull. 1074.

This strain was given the variety name "Denton" and seed was distributed to seven farmers.

The history and performance of strain No. 66 from 1920 to 1927 is as follows:

1920. Individual heads were selected from Mediterranean T. S. No. 3015. Seed from 520 separate heads was planted in head rows five feet long, in the fall of 1920.

1921. The most promising of the head rows, particularly those corresponding to Mediterranean in type, were harvested. Seed was re-

Figure 1. Plat of Denton wheat (left) in comparison with a plat of Kanred wheat, at Texas Substation No. 6, Denton, Texas.

tained from 126 strains. All others were discarded because they were untrue to type, lacked uniformity, or failed to produce sufficient seed.

1922. All remaining strains, 126 in number, were grown in "rod rows," 16½ feet long and one foot apart, interspersed at regular intervals with check rows planted to the original variety, Mediterranean, T. S. No. 3015. Strain 3015-66 produced at the rate of 9.6 bushels per acre as compared to 7.6 bushels for the nearest check plat.

1923. A total of 125 strains were tested in double-rod rows. Check rows were planted to T. S. No. 5935, an improved strain of Mediterranean which had proved to be superior in yield to T. S. No. 3015.

Strain No. 3015-66 yielded at the rate of 27.1 bushels per acre as compared with 22.8 bushels for the nearest check plat.

1924. A total of 112 strains were planted in double-rod rows with Mediterranean T. S. No. 5935 for comparison. Strain 3015-66 produced 41.6 bushels per acre; the nearest check plat 35.0 bushels. A three-year average of the 112 strains showed that Strain 3015-66 ranked second in yield.

1925. In the rod rows Strain 3015-66 produced 14.6 bushels per acre as compared to 13.1 bushels for the nearest check plat. Check plats this season were planted to Strain 3015-26, one of the selections which had shown promise in the earlier part of the test and had been sufficiently increased for that purpose. Strain 3015-66 was also grown in a field plat for the purpose of increasing the seed supply. In this plat it produced 6.6 bushels per acre as compared to 5.6 bushels for Kanred.

1926. Strain 3015-66 was grown as a check variety in field plats 2/55 acre in size and planted in duplicate. The average yield from eight plats was 28.2 bushels per acre as compared to 29.5 bushels for Mediterranean T. S. No. 5935. Although it did not produce the highest yield in the test, Strain 3015-66 was outstanding for its rust resistance, uniformity, strength of straw, and conspicuous performance in previous years and appeared to be the best "all around" wheat of all the strains which had been tested. This strain was named "Denton," a name suggested by S. A. Thompson of Denton County, and all available seed was distributed among seven farmers in North Texas, four of whom were members of the Denton County Pedigreed Grain Association.

1927. The yield of Denton wheat in field plats, 2/55 acre in size planted in triplicate, exceeded that of Kanred, Clark's Blackhull, Fulcaster, and several commercial and local strains of Mediterranean. The entire Station supply of seed was distributed to farmers and county agents outside of Denton County. The supply of seed produced by farmers of the Denton County Pedigreed Grain Association, remained in that organization and was distributed among its members.

Description of Denton Wheat

Denton wheat is a typical Mediterranean wheat except for its stem color, which is yellow rather than blue.

It is a soft winter wheat, characterized by brown chaff, yellow stem, rather tall-growing habit and mid-season maturity, ripening from one to three days later than ordinary Mediterranean.

The head is short to medium-long, compact, erect or slightly inclined, and bearded, showing no tendency to shatter after ripening.

The kernels are medium-long and soft, though not as soft in texture as Fulcaster or other typical soft wheats.

The color of the growing plant is a shade darker than most winter wheats. The early fall and winter growth is flat and spreading. The variety has a stiff straw and stands up moderately well under adverse

conditions. This characteristic was particularly conspicuous during the severe storm just prior to the harvest of the 1926 crop.

Denton wheat shows considerable resistance to both leaf and stem rust but is not immune to either disease.

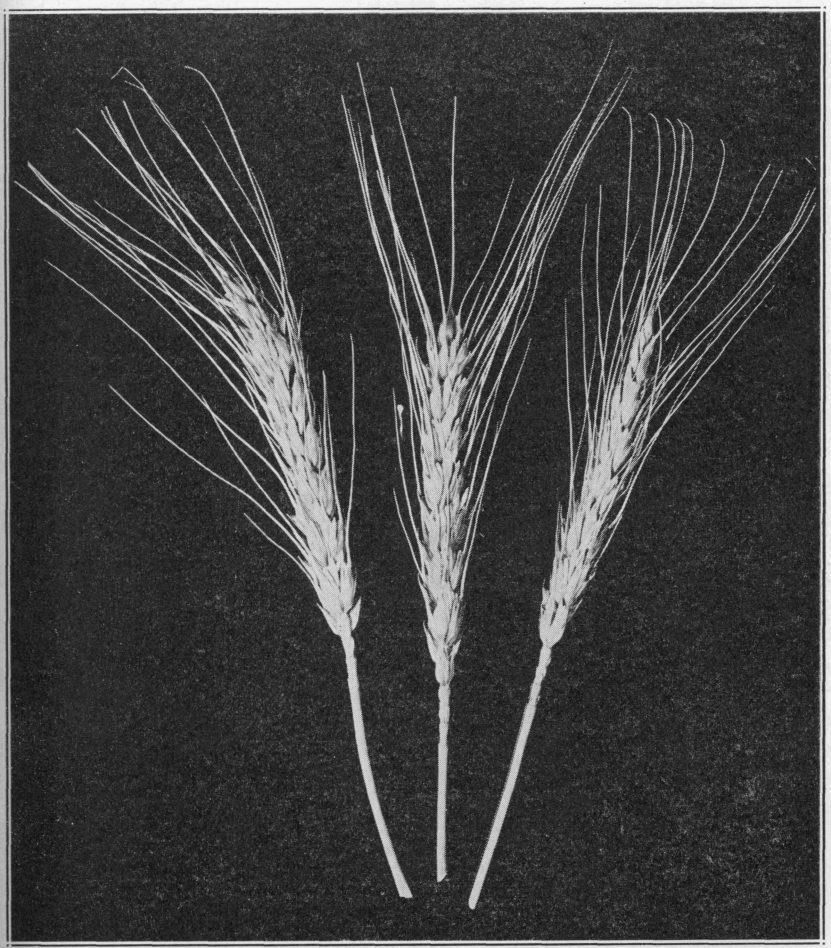

Figure 2 Typical heads of Denton wheat. Although larger heads are frequently produced, Denton wheat is usually characterized by rather short heads. The variety tillers profusely, however, and matures a larger number of heads per plant than most varieties, this fact probably accounting for the increased yields.

An agronomic description of Denton wheat compared with Mediterranean is as follows: (The description of Mediterranean wheat in the comparison is taken from U. S. Dept. Agric. Bull. 1074, "Classification of American Wheat Varieties," and represents the standard for Mediter-

ranean wheat that is relatively pure. Most of the wheat grown in Texas as Mediterranean includes so wide a mixture of various types that it can scarcely be described in single terms.)

Mediterranean (standard)		Denton
	Plant	
1. Winter habit		1. Winter habit
2. Midseason maturity		2. Midseason maturity
3. Tall		3. Tall
	Stem	
1. Purple		1. Yellow
2. Midstrong		2. Strong
3. Coarse		3. Coarse
	Spike	
1. Awned		1. Awned
2. Fusiform		2. Fusiform
3. Middense		3. Middense
4. Erect to inclined		4. Erect to inclined
	Glumes	
1. Glabrous		1. Glabrous
2. Brown		2. Brown
3. Long		3. Long
4. Midwide		4. Midwide
5. Easily deciduous		5. Not easily deciduous
6. Shoulders wanting to narrow		6. Shoulders wanting to narrow
7. Oblique		7. Oblique
	Beaks	
1. 1-8 mm. long		1. 2-9 mm. long
	Awns	
1. 3-7 cm. long		1. 2-6 mm. long
	Kernels	
1. Red		1. Red
2. Long		2. Long
3. Soft		3. Soft to semi-hard
4. Elliptical		4. Elliptical
5. Germ midsized		5. Germ midsized
	Crease	
1. Midwide		1. Midwide
2. Middeep		2. Shallow—middeep
	Cheek	
1. Rounded		1. Rounded
	Brush	
1. Midsized		1. Midsized
2. Midlong		2. Midlong

YIELD OF DENTON WHEAT

Results at Denton

Although Denton wheat has been tested for yield at the Denton Station since 1922, it was not compared directly with more than one other variety each season until 1926. It has, however, always been compared directly in the nursery with a check variety, which in turn was tested in field plats with other varieties commonly grown in North Texas. It was compared directly with Mediterranean T. S. 3015 in 1922; with Mediterranean T. S. 5935 in 1923 and 1924, and with Kanred in 1925. Since these last-mentioned varieties were also included in the general variety test, it is possible to make an indirect

comparison between Denton wheat and other varieties for the entire period, 1922-1927. This has been done in Table 1. The yields of Denton wheat marked with an asterisk were calculated by determining the percentage increase of Denton over the check variety in the nursery and by adding the percentage to the yield of the same variety grown in the field plats. Though this method of comparing the yields is not as satisfactory as would have been a direct comparison, it appears to be fairly accurate in this case. The differences in favor of Denton as shown by this comparison have been amply substantiated by the experience of farmers who have grown the new variety in comparison with others.

Table 1.—Yields of Denton wheat and other varieties at Texas Substation No. 6, Denton 1922-1927.

T. S. No.	Variety	Yield in bushels per acre						Corrected Average
		1922	1923	1924	1925	1926	1927	
9236	Denton	*19.0	*32.7	*46.3	*17.2	28.3	20.6	27.3
7172	Clark's Blackhull	.....	29.5	44.9	15.4	30.4	14.5	25.2
1499–1	Kanred	17.1	30.5	43.0	14.6	27.8	14.0	24.5
5935	Mediterranean	15.2	27.5	38.9	13.0	29.5	19.8	24.0
7063	Mediterranean	.....	.....	.....	13.7	27.2	17.2	23.7
3015	Mediterranean	15.0	25.6	40.3	.....	.....	.....	22.7
5932	Mediterranean	13.8	28.6	40.6	10.5	.....	.....	22.7
6584	Mediterranean	10.6	30.3	39.9	12.3	.....	.....	22.6
5937	Mediterranean	14.8	27.9	37.1	.....	.....	.....	22.4
7082	Fulcaster	.....	.....	.....	.....	21.3	17.7	20.7

*Based on nursery yields.

Table 1 indicates that Denton wheat has exceeded in yield Clark's Blackhull by 2.1 bushels per acre; Kanred by 2.8 bushels; Fulcaster by 6.4 bushels, and T. S. 5935, the highest yielding Mediterranean, by 3.3 bushels.

The comparison between Denton and Mediterranean strains T. S. 3015, 5932, and 6584 is interesting in showing the improvement which has been effected by pure-line selection. These three strains represent the Mediterranean variety as it is commonly grown in North Texas. The strain numbered T. S. 3015 has been grown in Grayson County since 1900 or earlier. T. S. 5932 was obtained from Vernon, Texas, by W. E. Smoot in 1903 and has been grown in Denton County as Smoot's Mediterranean since that time. T. S. 6584 was brought to Denton County about 1881 by J. W. Underwood and has been grown in the locality since that date.

These three strains are alike in being made up of a wide assortment of distinct types and in representing the Mediterranean variety as it is commonly grown in North Texas. Table 1 shows that they are practically identical in yield, the first two averaging 22.7 bushels, and the third one 22.6 bushels per acre. Denton wheat has averaged 4.6 bushels per acre more than any of these three varieties; an increase of 20 per cent. In other words, the pure-line selection work of the Denton Sta-

tion, which has been merely a process of isolating the many strains now found in common Mediterranean, discarding the undesirable strains and thoroughly testing the better ones, has resulted in an improvement of 20 per cent in productivity without any apparent loss of the desirable qualities which have made Mediterranean wheat a popular variety in North Texas.

That the superior productiveness of the new variety is not confined to the Denton Station is attested by the fact that it was grown by four Denton County farmers in 1927 and thirteen Denton County farmers in 1928. In every case where another variety was also grown on the same farm, the Denton wheat made the higher yield. Some of the increases reported by the farmers are much greater than those shown by the Station tests and can probably be attributed to the fact that farmers frequently devote their best land to a new variety which they desire to increase. However, even in instances where this obviously did not occur, the Denton wheat proved to be superior to other varieties.

Results at Temple

Owing to the removal of Texas Substation No. 5 to a new site in the fall of 1927, no yields of wheat from this Station are available for 1928. Denton wheat was tested in comparison with other varieties at Temple in 1927. The results are set forth in Table 2.

Table 2.—Yields of Denton wheat and other varieties at Texas Substation No. 5 Temple, 1927.

T. S. No.	Variety	Yield in bushels per acre		
		Series 1	Series 2	Average
9236	Denton	18.8	17.0	17.9
4081	Acme Durum	10.1	13.3	11.7
2536	Alabama Bluestem	10.5	11.5	11.0
1499–1	Kanred	11.0	9.2	10.1
7172	Clark's Blackhull	10.1	9.6	9.8

Results at Chillicothe

Results of a comparison of Denton wheat with other varieties at Texas Substation No. 12, Chillicothe, are available for two years and are shown in Table 3. The yields of each of the four replications are included in addition to the average yields in order to show the consistent differences between varieties in these tests.

In 1927, Denton wheat made the highest yield, slightly exceeding Clark's Blackhull, which has previously been the highest-yielding variety in this section. In this test Denton proved to be significantly superior to Kanred, Fulcaster, and Turkey, yielding higher than these varieties in each of the four replications with the exception of one comparison with Fulcaster.

Table 3.—Yields of Denton wheat and other varieties at Texas Substation No. 12, Chillicothe, 1927-1928.

	Yield in bushels per acre					
	Denton	Clark's Blackhull	Kanred	Fulcaster	Turkey	Mediterranean 3015–72
1927 Series 1	17.5	15.6	15.6	15.4	10.7	.....
1927 Series 2	16.5	16.5	14.7	16.5	9.3	.....
1927 Series 3	17.9	16.9	16.6	15.1	10.8	.....
1927 Series 4	16.0	16.7	14.3	16.7	9.9	.....
Average	17.0	16.4	15.3	15.9	10.2	.....
1928 Series 1	4.8	12.7	8.2	4.4	.....	3.4
1928 Series 2	4.9	13.8	11.5	4.2	.....	2.5
1928 Series 3	4.3	11.0	8.7	3.6	.....	2.1
1928 Series 4	4.4	10.5	7.2	2.9	.....	2.3
Average	4.6	12.0	8.9	3.8	.....	2.6
Average 1927-28	10.8	14.2	12.1	9.9	.....	.....

Due to a prolonged drouth, followed by a severe sand storm, the season of 1928 was very unfavorable for wheat and in this test the higher yields were made by the hard-wheat varieties, Clark's Blackhull and Kanred. Among the soft-wheat varieties, however, Denton produced higher yields than Fulcaster and Mediterranean 3015-72 in each of the four comparisons.

In considering these results it should be remembered that Hardeman County, in which Substation No. 12 is located, is practically outside of the soft-wheat belt of Texas. This section is, and probably should continue to be, primarily devoted to growing hard wheats. These tests show, however, that Denton wheat may be expected to rank with hard wheats, such as Clark's Blackhull and Kanred, in favorable seasons, and that it will probably prove superior to other soft-wheat varieties under any conditions occurring in this section.

AREA TO WHICH DENTON WHEAT IS ADAPTED

Although it is too early to define sharply the area to which Denton wheat is adapted, the experience of farmers in North Texas and Southern Oklahoma, and such tests as have been conducted at the Texas Substation at Denton, Temple, and Chillicothe, indicate that Denton wheat is similar to ordinary Mediterranean in its soil and climatic adaptation. In other words, Denton wheat can probably be successfully grown in any section where Mediterranean has proved to be a satisfactory variety. The region of North Texas in which Mediterranean wheat has been commonly grown in the past, is shown in Figure 3. This figure is based on a survey made by the U. S. Department of Agriculture in 1919 and reported in U. S. D. A. Bulletin 1074.

Counties in which Denton wheat has been grown either by the Station or by farmers and in which it has proved equal or superior to other varieties, are shown in black in Figure 3. The tests, though preliminary

in nature, show that Denton wheat is as well adapted as Mediterranean, to the eastern, southern, and northwestern limits of the Mediterranean wheat region of Texas. Unfortunately, no figures are available for the southwestern section of this region.

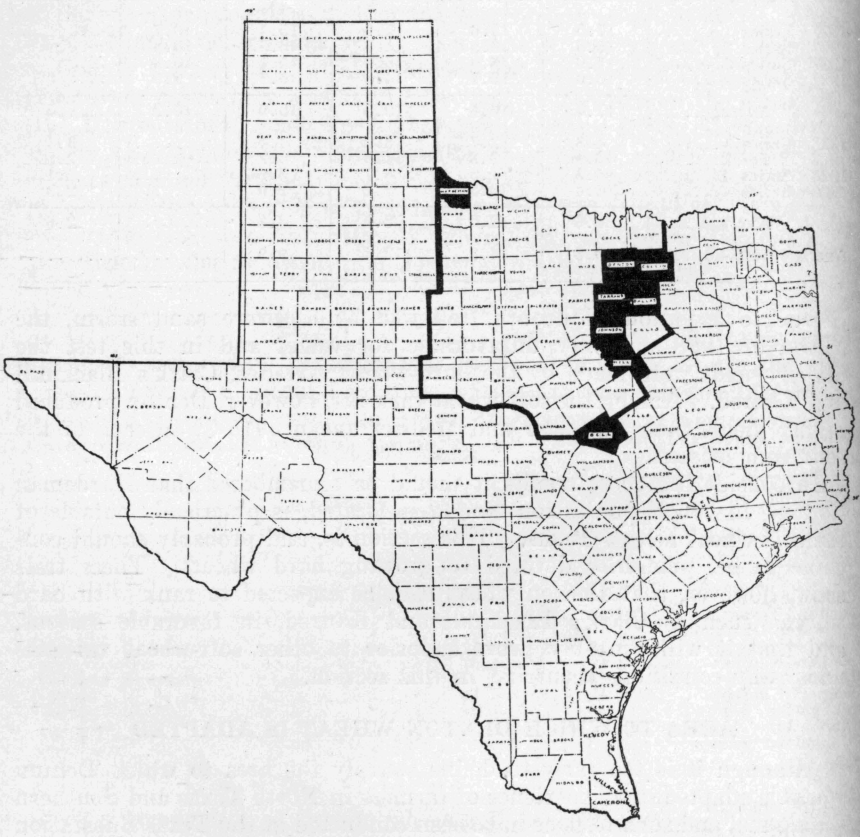

Figure 3. Section of Texas where Mediterranean wheat is grown. Denton wheat should prove equal or superior to ordinary Mediterranean throughout this section. Area in black indicates counties where Denton wheat has been tested.

It would appear that wheat farmers in the western part of this region should give the variety a preliminary trial on a small scale before sowing large acreages to Denton wheat, but that farmers throughout the eastern part of the region shown in Figure 3 are justified in replacing their present varieties of wheat with the new Denton variety as rapidly as seed becomes available.

RUST RESISTANCE

Both leaf rust and stem rust of wheat are prevalent in North Texas and frequently cause considerable damage. Stem rust, commonly known as "black rust," affects chiefly the stems and is characterized by long, angular pustules which are reddish brown in color, later changing to black. This form of rust does not occur every season and sometimes appears too late to cause much damage. When the epidemic is severe, however, its effects are very noticeable. The grain on severely infected plants is shriveled and yield is reduced.

Leaf rust is characterized by small, round pustules, which are orange red in color, and are confined chiefly to the leaves. This form of rust has been present in epidemic proportions for a number of years and is apparently a more serious disease in North Texas than stem rust. Because leaf rust has no apparent effect on the plumpness of the grain, it has been generally supposed that it has little influence on yield. It is now known, however, that leaf rust affects the yield, not by shriveling the grain but by reducing the number of grains set per spikelet or "mesh." There can be no question that it affects very seriously the functions of the wheat plant. At the Denton Station in both 1927 and 1928 many strains were so injured by leaf rust that they produced practically no grain and in some instances even failed to head out.

Table 4.—Reaction of Denton wheat and other varieties to leaf rust in Texas, Oklahoma and Kansas.

Variety	Year	Percentage infection				
		Denton	Kanred	Blackhull	Superhard Blackhull	Fulcaster
College Station, Texas....	1928	Trace	40	.....	40	25
Denton, Texas.....	1928	20–40	60–80	.....	25–60	40–60
Stillwater, Oklahoma.....	1928	10–40	40–60	.....	Tr–20	40–60
Hays, Kansas.....	1928	10–30	40–60	.....	50–70	40–60
Harper, Kansas.....	1926	Trace	5–30	5–20	.....	0–10
Harper, Kansas.....	1927	Tr– 5	30–50	30–50	.....	70–90
Harper, Kansas.....	1928	Tr– 5	Tr–30	20–40	20–40	0–Tr
Manhattan, Kansas.....	1926	Tr–10	30–60	50–70	.....	Tr–70
Manhattan, Kansas.....	1927	10–40	30–60	50–70	.....	Tr–80
Manhattan, Kansas.....	1928	40–60	30–50	60–80	60–80	40–60

The reaction of Denton wheat to leaf rust in comparison with other varieties is shown by Table 4. The data in this table were supplied through the courtesy of Mr. C. O. Johnston, Pathologist of the Office of Cereal Crops and Diseases, U. S. Dept. of Agriculture. As there are many distinct physiologic forms of leaf rust, occurring in different regions, and as a variety may be resistant to one form and completely susceptible to another, the reaction of Denton wheat is shown for six localities in the Great Plains. It is evident that Denton wheat has been more resistant than Kanred, Blackhull, or Fulcaster in every comparison, except the 1928 test at Manhattan, Kansas. Mr. Johnston has also kindly furnished a report on the reaction of Denton wheat when artificially inoculated in the greenhouse with Physiologic Form 9, the most common form

occurring in North Texas. This test showed 85 per cent of the plants to be rust free; 15 per cent, resistant.

Complete data on the reaction of Denton wheat to stem rust are not available. Field notes at Denton indicate, however, that it is not as resistant to stem rust as Kanred, but more resistant than Fulcaster and ordinary Mediterranean.

STIFFNESS OF STRAW

One of the essential characteristics of wheat varieties for North Texas is stiffness of straw. Because of the frequence of storms during the time that wheat is maturing, it is important that the varieties grown in this region have the ability to stand up under adverse conditions. Severe lodging renders the crop difficult to cut and makes it almost impossible to harvest the field clean. Resistance to lodging will undoubtedly become increasingly important as binders are replaced by combine harvesters and cutting is delayed until the grain is dead ripe.

Field notes on Denton wheat since 1922 have shown that this variety is fairly resistant to lodging.

As lodging does not occur every year in the field and as it is frequently difficult to measure the degree of lodging, an effort is now being made to measure resistance to lodging by determining the breaking strength of straw in the laboratory. A machine, designed by Prof. S. C. Salmon of the Kansas Experiment Station and manufactured for the Texas Station under his supervision, has been used for the past two seasons in determining the strength of straw of the varieties and strains grown at the Denton Substation.

Table 5.—Breaking strength of straw of Denton wheat and other varieties grown at Denton in 1927–28.

T. S. No.	Variety	Breaking strength in pounds per straw		
		1927	1928	Average
9236	Denton	1.077	1.084	1.080
5935	Mediterranean	.790	.920	.855
7182	Fulcaster	.822	.724	.773
7172	Clark's Blackhull	.750	.659	.705
1499–1	Kanred	.685	.522	.604

The average breaking strength of 50 straws each of Denton and other varieties is shown in Table 5.

It may be noted that Denton wheat showed the strongest straw both years. Based on a two-year average, the straw of Denton wheat was 26.3 per cent stronger than Mediterranean 5935; 39.7 per cent stronger than Fulcaster; 53.2 per cent stronger than Clark's Blackhull; and 78.8 per cent stronger than Kanred. Since strength of straw is probably the main factor determining resistance to lodging, it would appear that Denton wheat is very satisfactory from this standpoint, or at least is appreciably superior to other varieties commonly grown in North Texas.

UNIFORMITY

All the plants of a pure-line are genetically identical and except for variations caused by environment should be completely uniform. Denton wheat has been noticeably uniform since it was first grown in 1922 in every respect, with one exception. This exception is a light green, awnless, rust-susceptible type with velvet chaff that appears in every field of Denton wheat at the rate of approximately one or two plants per acre. As this type of rogue occurs too rarely to have any effect on yield or uniformity and as it serves as an excellent "marker" in identifying a field of Denton wheat, no effort has been made to eliminate it from the variety. Except for the rare occurrence of the velvet chaff rogue Denton wheat appears to be completely pure and uniform and because of its uniformity should grade higher on the market than ordinary Mediterranean, which has a reputation, not only in Texas but in northern grain centers as well, of being a mixed variety.

Table 6.—Results of milling and baking tests of Denton whent and other varieties grown at Denton in 1926.

T. S. No.	Variety	Lbs. per Bu. after cleaning	Flour, per cent	Absorption, per cent	Loaf, volume in c.c.	Color, per cent	Texture, per cent
9236	Denton	56.9	70.0	70	2110	96	98
7063	Mediterranean	58.0	69.5	70	1970	96	94
1499–1	Kanred	55.9	71.8	70	1810	94	86
7172	Clark's Blackhull	60.1	72.5	66	1630	95	86

MILLING AND BAKING QUALITIES

The final criteria of the value of a new wheat variety and almost equal in importance to yield, are the milling and baking characteristics. Milling and baking tests of Denton wheat in comparison with other varieties have been made since 1926.* These tests show that Denton wheat is equal or slightly superior to ordinary Mediterranean as a commercial bread wheat and is superior to Kanred and Clark's Blackhull grown in this section. Tables 6, 7 and 8 give the detailed report of these tests in the 1926 and 1927 crop.

The test weight was taken after the wheat was cleaned on an experimental separator. The "per cent of flour" represents the actual percentage of flour obtained from the sample. The per cent absorption is the percentage of water absorbed by the flour in making a dough of the required stiffness. The loaf volume represents the actual volume of a loaf produced by a given amount of flour, which was uniform for all samples. This measurement is the best criterion, from the baker's standpoint, of the commercial value of the flour. The figures for color

*All milling and baking tests have been made by the Department of Milling Industry of the Kansas Experiment Station.

and texture are based entirely upon judgment, using as a standard a loaf baked from commercial flour made from strong Turkey wheat.

Table 7.—Results of milling and baking tests of Denton wheat and other varieties grown at Denton in 1927.

T. S. No.	Variety	Lbs. per Bu. after cleaning	Flour, per cent	Absorption, per cent	Loaf, volume in c.c.	Color, per cent	Texture, per cent
9236	Denton	55.0	69.5	67	2220	98	99
7063	Mediterranean	54.8	68.5	73	2080	98	99
5935	Mediterranean	53.8	70.0	67	2020	92	90
1499–1	Kanred	52.5	69.5	76	1880	92	90
7082	Fulcaster	55.2	68.8	67	1980	96	94
7172	Clark's Blackhull	54.3	70.0	85	1820	92	88

These tests show conclusively that Denton wheat is equal or superior as a bread wheat to the varieties commonly grown in North Texas. In loaf volume it has excelled all other varieties in each of the three tests, while in color and texture it has been equal or superior to Mediterranean, Kanred, Clark's Blackhull, and Fulcaster.

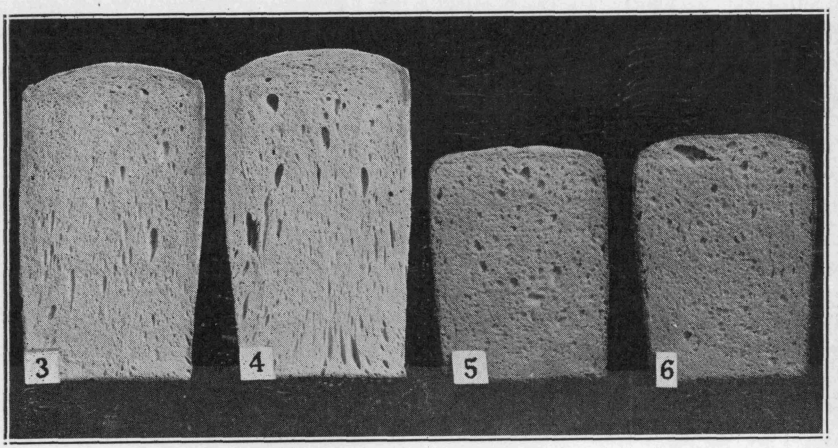

Figure 4. Loaves of bread baked from (3) Mediterranean, (4) Denton, (5) Acme Durum and (6) Clark's Blackhull wheat. Denton wheat has proved superior, in loaf volume, to all other varieties tested.

SOURCES OF SEED

Texas Substation No. 6 at Denton has for the past three seasons grown as large an acreage as possible of Denton wheat for distribution to farmers. This Station will continue to produce and distribute a limited amount of seed of this variety so long as there is a demand for it; the principal supply of pure seed, however, must always remain in the hands of farmers who exercise care in producing their crop, keeping it free from field and thresher mixtures, and from weed seeds.

Table 8.—Results of milling and baking tests of Denton wheat and other varieties grown at Temple in 1927.

T. S. No.	Variety	Lbs. per Bu. after cleaning	Flour, per cent	Absorption, per cent	Loaf, volume in c.c.	Color, per cent	Texture, per cent
9236	Denton	58.0	71.8	66	2150	96	97
2536	Alabama Bluestem	57.8	70.0	68	1990	96	94
1499–1	Kanred	56.5	71.3	67	1920	94	92
7172	Clark's Blackhull	58.5	70.0	69	1715	90	85
4081	Acme Durum	58.5	67.0	79	1615	85	83

Groups of farmers have organized in several counties for the purpose of producing and maintaining the purity of new and improved strains of small grains developed by the Texas Station. Members of these Pedigreed Grain Associations have agreed to grow their seed crop on grain-free land, to rogue all Johnson grass and other noxious weeds, thresh in a cleaned machine, and sell only seed from stocks obtained from the Station not more than three years previously. Fields of grain grown by members of these associations are inspected by the county agents and by representatives of the Experiment Station.

Although these associations probably now represent the most satisfactory source of seed, individual farmers or seedsmen who will observe the same precautions as are required of association members should be able to produce and market pure seed of Denton wheat or other varieties of small grain.

The names of associations, farmers, or seedsmen from whom seed of Denton wheat may be obtained, will be furnished on request.

OTHER STRAINS DISTRIBUTED BY DENTON SUBSTATION

Realizing that the value of a new variety depends upon its performance under farm conditions, the Denton Substation has followed, for a number of years, the practice of distributing to a few farmers some of the more promising strains developed by pure-line selection.

Most of these strains have proved superior to ordinary Mediterranean in yield and uniformity and have been increased and further disseminated by farmers. Following the naming and distribution of Denton wheat, the demand for seed of the new variety has been so urgent that some of the other strains developed and distributed by the Denton Station, but never named, have been sold as Denton wheat. This situation has probably been entirely unintentional but it necessitates a warning to prospective buyers of Denton wheat to be certain that the seed offered for sale is Denton wheat, and not merely a strain developed by the Denton Substation and released for trial before Denton wheat was distributed.

SUMMARY

1. Denton wheat is a new variety of soft red winter wheat isolated by pure-line selection from the Mediterranean variety.

2. Denton wheat is a typical Mediterranean wheat in practically all characters except stem color, which is yellow rather than blue.

3. It has proved to be superior in yield to Kanred, Clark's Blackhull, Mediterranean, and Fulcaster, in tests conducted at Denton; superior to all varieties with which it was compared in a one-year test at Temple, and to other soft-wheat varieties in a two-year test at Chillicothe.

4. Denton wheat appears to be well adapted to the section of North Texas which is now growing ordinary Mediterranean wheat.

5. In resistance to leaf rust Denton wheat has proved superior to Kanred, Clark's Blackhull, and Fulcaster.

6. Denton wheat has a stiff straw. Actual breaking tests show the straw of Denton wheat to be 26.3, 39.7, 53.2, and 78.8 per cent stronger than Mediterranean, Fulcaster, Clark's Blackhull, and Kanred, respectively.

7. Laboratory baking tests indicate that Denton wheat produces a loaf of bread superior in volume, texture, and color to other varieties commonly grown in North Texas.